

DIPTERA ASSOCIATED WITH SHELF FUNGI AND CERTAIN OTHER MICRO-HABITATS IN THE HIGHLANDS AREA OF WESTERN NORTH CAROLINA^{1,2}

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ABSTRACT: Diptera collected primarily from species of woody fungi in western North Carolina (Macon, Jackson, and Transylvania counties) are discussed. The families represented include Ceratopogonidae, Chironomidae, Mycetophilidae, Sciaridae, Cecidomyiidae, Lonchopteridae, Phoridae, and Drosophilidae.

This is the seventh in a series of papers on the arthropods associated with the sporocarps of woody shelf- or bracket-fungi (chiefly Polyporaceae) in the Blue Ridge Mountains area near Highlands, North Carolina (Graves and Graves 1966a, 1966b, 1968, 1969, 1970, Graves et al. 1977). A bibliography of publications on mycophagous insects has been published by Fogel (1975).

Information on the Highlands area, collecting methods (extraction funnel), and detailed habitat and collection data may be found in Graves and Graves (1966a). The paired code numbers (e.g., 120-1) refer to this information, the second number in each pair being the number of individuals collected. Collection numbers beginning with "C" refer to non-fungus habitats (data listed in Graves and Graves 1969). In the following checklist, the general types of microhabitats in which each species was collected are indicated as follows: F - fungi, L - rhododendron leaf litter, M - moss, S - sawdust pile, and T - tree-hole debris.

Checklist of Diptera

Ceratopogonidae

Atrichopogon sp. (M) (C101-1)

Forcipomyia (new subgenus near *Lepidohelea*) new species 1 (F) (120-1, 121-1, 125-1, 130-1, 134-1, 141-6, 147-15, 149-1, 151-1, 159-6, 180-1, 213-1, 215-1, 217-1, 218-1)

F. (Forcipomyia) bipunctata (L.) (F) (147-1)

F. (Forcipomyia) fuliginosa (Meigen) (F) (141-1)

F. (Forcipomyia) sp. (F,S,M) (156-1, 158-1, C110a-1, C115-1)

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- Dasyhelea oppressa* Thomsen (F) (146-1, 189-7 adults, 4 pupae, 15 larvae)
Culicoides obsoletus (Meigen) (F) (116-1)
C. sanguisuga (Coquillett) (F) (119-1, 129-1, 130-2, 133-1, 141-2, 142-1, 159-1, 164-1, 170-1, 190-1)
C. debilipalpis Lutz (F) (141-1)
Culicoides new species, *piliferus* group (F) (149-1)
C. snowi (F) Wirth and Jones (130-1)
C. haematopotus Malloch (M) (C118-1)
Culicoides spp. (F) (141-1 larva, 189-2 larvae)
Monohelea johannseni Wirth (F) (159-1)
Palpomyia sp. (M) (C118-1)
- Chironomidae**
 Genus undetermined (104-1, 105-1, 106-2, 107-2, 108-2, 109-1, 111-1, 115-1, 125-13, 126-1, 129-4, 132-1, 133-6, 134-6, 135-1, 136-2, 140-1, 141-17, 142-2, 145-5, 146-1, 147-2, 148-1, 155-3, 156-1, 158-1, 159-5, 189-2, 204-1, C111-1, C127-1)
Polypedilum sp. (M) (C101-1)
- Mycetophilidae**
Synapha bicolor Shaw and Fisher (F) (159-1)
 Genus undetermined (larvae) (F) (105-1, 131-5, 141-10, 158-25, 171-5, 204-1, 208-2)
- Sciaridae**
Sciara sp. (F) (200-1)
Bradysia species (F,M) (107-1, 150-1, 168-1, 204-1, 213-1, C106-1)
- Cecidomyiidae**
Didactylomyia longimana (Felt) (M) (C106-1)
Porricondyla species (F,M) (110b-1, C111-1)
Lestodiplosis species (F,M) (adults: 107-2, 110b-4, 114-2, 144-2, 145-3, 150-3, 157-1, 163-1, 210-2, C111-2) (larvae: 108-2, 151-1, 188-10, C100-2)
 Genus undetermined (larvae) (108-8, 137-50, 141-25, 142-4, 158-25, 166-1, 172-4, 180-2, 210-100, 213-50, 215-10, 219-100)
- Lonchopteridae**
Lonchoptera furcata (Fallén) (F) (145-1)
- Phoridae**
Dohrniphora sp. (F,M) (102-1, C106-1)
 Genus undetermined (larvae) (156-25, 205-15)
- Drosophilidae** (undetermined) (F) (141-1, 162-2, 201-1, 214-2, 219-1)
- Family undetermined** ("all larvae - either Phoridae, Drosophilidae or possibly Chironomidae") (111, 112, 114, 122, 125, 128, 129, 136, 138, 139, 140, 141, 144, 146, 149, 155, 158, 159, 163, 169, 171, 173, 178, 180, 183, 188, 189, 200, 201, 207, 208, 209, 214, 215, 217, 219b, 220, C100, C101, C102, C105, C106, C107, C108, C109, C111, C114, C115, C116, C117, C118, C119)

DISCUSSION

Nearly a quarter-century ago one of us (RCC) stated that the study of fungus-inhabiting Diptera has virtually been ignored (Graves 1960). More than a decade later Ackerman and Shenefelt (1973) remarked that "even today very little is really known about these insects, their specific biologies and the types of associations they enter into with fungi; even their taxonomy is not well worked out." This is still true today, and the study of

mycetophagous Diptera remains in its pioneer stages.

Ceratopogonidae are minute flies (1-4 mm.) and are poorly known (Wirth 1965a). The adults of most species suck the blood of vertebrates or other insects, and the larvae are found in a variety of aquatic, semiaquatic or terrestrial habitats (Wirth 1965a). Although a few species have been reared from polyporoid fungi (Jamnback and Wirth 1963), these fungi do not seem to be an important habitat for ceratopogonid larvae — none were found by Ackerman and Shenefelt (1973) in Wisconsin, for example. However, the rainfall in the areas collected around Highlands, NC, averaged more than 76 in. to more than 84 in. in places (USDA 1941). As the decaying sporocarps tended to remain constantly moist, the habitat was more suitable for semiaquatic larvae.

The *Atrichopogon* was found in *Sphagnum*-like moss on rocks beneath rhododendrons, a semiaquatic habitat typical of this genus (Wirth 1965a). Of particular interest was the "*Forcipomyia* (new subgenus near *Lepidohelea*) new species 1" which W. W. Wirth (in litt.) plans to describe in a future publication. This was the commonly collected ceratopogonid in this study, and was found at 13 sites, all of which were fungi. However, only a single specimen was obtained from each site, except for a sporocarp of *Polyporus gilvus* (Schw.) Fries which was riddled with the tunnels of termites, *Reticulitermes virginicus* Banks (Graves and Graves 1968) and contained 15 *Forcipomyia* n.sp. 1. Many ceratopogonids are predaceous on other insects (Wirth 1965a) but any attempt to associate this new species with termites would be pure speculation.

Dasyhelea oppressa has been reared from moist tree-hole debris and slime fluxes on tree bark (Waugh and Wirth 1976). All stages of this species were found in a decayed *Polyporus sulphureus* sporocarp on the ground and soaking wet at an altitude of 3200 ft. This is a new record of woody fungi as a habitat of *D. oppressa* larvae, but it is a habitat little different from those previously mentioned.

The larvae of the biting midges, *Culicoides*, inhabit wet, decomposing plant material and leaf compost (Wirth 1965a). *C. sanguisuga* is the most abundant and important species of biting midge as a pest of humans in the forested areas of eastern North America (Jamnback and Wirth 1963). *C. debilipalpus* larvae are found in stump holes and tree-holes, and *C. snowi* in tree-holes (Battle and Turner 1971). The unidentified *Culicoides* larvae were collected from two species of *Polyporus* in late decompositional stages.

As it was not possible to obtain determinations on Chironomidae, little can be discovered about the species in this family. Most chironomid larvae are aquatic but some are found in moist terrestrial habitats. Seventeen adults were found on *Polyporus* in late stages of decay, broken up and fallen

on the ground, with phalangids and chironomids resting on the surface. The *Polypedilum* was collected from *Sphagnum*-like moss on rocks beneath rhododendrons. Associations between Chironomidae and shelf fungi are apparently incidental, and adults were probably resting or hiding in crevices in the fungi when collected.

Both the Mycetophilidae and the closely related Sciaridae contain many species that are closely associated with fungi. *Synapha bicolor* is recorded only from New York and Rhode Island in Laffoon (1965). *Sciara* were also collected from polypores in Michigan and Illinois by Graves (1960) and in Québec by Pielou (1966), and *Bradysia* from several species of woody fungi in Wisconsin (Ackerman and Shenefelt 1973) and Canada (Pielou and Verma 1968).

Although Cecidomyiidae are found in a great variety of ecological niches, the larvae of many species are fungus feeders (Cole 1969) and are known to inhabit the sporocarps of several species of woody fungi (Ackerman and Shenefelt 1973, Graves, 1960, Pielou 1966). The larvae of the eastern species of *Lestodiplosis* are thought to be predatory on other insect larvae (Cole 1969). The larvae of *Lestodiplosis* were found in several species of fungi, and also in moss on the forest floor. Both *Lestodiplosis* and *Porricondyla* were collected from *Polyporus* in Canada (Pielou and Verma 1968). *Didactylomyia longimana* is recorded only from Massachusetts and New York by Foote (1965).

The larvae of Lonchopteridae are found under leaves and decaying vegetation and *Lonchoptera furcata* is a worldwide species (Wirth 1965b). Its occurrence in fungi is probably incidental.

The Phoridae have diverse larval habits, but many have been reared from fungi (Schmitz and Bayer 1965) and have been collected previously from shelf fungi (Graves 1960, Ackerman and Shenefelt 1973). In the present study, however, phorid larvae were determined only from softer fungi (*Boletus*).

Several species of Drosophilidae have been collected from shelf fungi, but that family is much more closely associated with mushrooms and other soft fungi. The few specimens of Drosophilidae were sent for identification and were lost.

The Diptera are certainly a major group of fungus inhabiting insects, but the ecology of most species of mycetophilous Diptera is still very poorly known. This is due in part to the technical difficulties of obtaining species determinations of several families, and especially in the case of larval stages, which are most common in moist fungi. It is hoped that systematic and ecological researchers will continue to broaden and deepen our knowledge of the inter-relationships between fungi and Diptera.

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INTERNATIONAL COMMISSION ON ZOOLOGICAL NOMENCLATURE

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ITZN 59

The following opinions have been published by the International Commission on Zoological Nomenclature in the *Bulletin of Zoological Nomenclature*, volume 41, part 4, on 30 November, 1984:

Opinion No.

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| 1277 (p. 212) | <i>Ptilium</i> Gyllenhal, 1827 and <i>Ptenidium</i> Erichson, 1845 (Insecta, Coleoptera): conserved. |
| 1279 (p. 218) | <i>Chrysolina</i> Motschulsky, 1860 (Insecta, Coleoptera): conserved. |
| 1283 (p. 227) | LYMANTRIIDAE Hampson, [1893] given nomenclatural precedence over ORGYIIDAE Wallengren, 1861 and DASYCHIRIDAE Packard, 1864 (Insecta, Lepidoptera). |
| 1284 (p. 231) | <i>Pegghichisme</i> Kirkaldy, 1904 (Hemiptera, Heteroptera): designation of type species. |
| 1286 (p. 235) | <i>Chermes fusca</i> Zetterstedt, 1828 (Insecta, Homoptera): conserved. |
| 1287 (p. 238) | <i>Sesia andrenaeformis</i> Laspeyres, 1801 (Insecta, Lepidoptera): conserved. |

The Commission regrets that it cannot supply separates of Opinions.

R. V. MELVILLE, Secretary